

the description of the jet black larva of the Peacock Butterfly as "dusky greenish" (p. 21), the assertion that the present writer discovered uric acid in the excreta of Vanessa imago (p. 41), the implication that leaf-mining larvae eat only the deeper tissues of the leaf instead of everything between the upper and lower cuticle (p. 63), the description of "red eye-like markings upon the blue underwings" of the Eyed Hawk Moth (p. 134), in which red and blue should of course be transposed.

The book is well printed, misprints such as "Tortorix" for "Tortrix" (83), "freshly-moulded" for "freshly-moulded" (67), "distinction" for "distinctive" (185) being fortunately uncommon.

The coloured plates are good, although it would have been a pleasure to see the wings of one of the resting *Volucella* in Plate IV. folded one over the other in a very characteristic attitude. The antennæ of the *Kallima* shown at rest in Plate II. would have been concealed, and the same applies to the figures of the Buff-tip and Lappet Moths. The worst figure is that of the Bee Hawk Moth on p. 245, in which an entirely wrong notion of the opaque border to the wings is conveyed. The source of the figures is not mentioned.

EDWARD B. POULTON.

SUNSHINE.

Sunshine. By Amy Johnson, L.L.A. (London Macmillan and Co., and New York, 1892.)

THIS book is likely to puzzle any one who may by chance pick it up and glance casually over the pages, more especially if he should happen to first open it towards the end and find two chapters headed "Tommy's Dream," concluding with a conversational account of how "the nurse puts baby into a bath, generally too hot or too cold, and scrubs away as if he were a wooden doll. Poor baby's skin is red all over, and he screams with pain," &c. On the other hand, in the early part of the book, several familiar figures, such as pictures of ice flowers, or diagrams of the action of simple lenses, of total reflection, of the rainbow, &c., show that "Sunshine" is, in spite of the nursery episode, in reality connected with physical science. As a matter of fact the authoress has taken a number of easy experiments and every-day observations, and has amplified and explained them in a simple and often very charming manner, adopting for the purpose the conversational form as between herself, called teacher, and, judging by the number of Christian names of the children addressed, a host of youngsters.

The conversational style is out of fashion just now, but no objection can be taken on that account. What is of far more importance is the general effect produced upon the mind of the child. The writer of this notice well remembers how the attempt was made to beguile him into being interested in conversations between a horridly precocious child Willie and his papa. Willie always said the right thing, and always made the right mistakes, so that much instruction was to be gathered from the answers and corrections of his papa. The

writer, no doubt, did acquire some general information; perhaps he did not resent the attempted deception, but he is sure that he would like to have punched Willie's head, or to have made him suffer in some way that is pleasing to the boyish imagination. In the present instance the risk of arousing open hostility on the part of children who may receive instruction from the pages of "Sunshine" is largely reduced by the fact that the conversation is very one-sided; the children are made to say very little in these talks—they are not quite lectures, but more lectures than conversations. Whether "teacher" says too much, or in the attempt to appeal to the imagination rather than the reasoning faculties of her audience rambles too far afield, is a question of taste. Many parts of the book demand the highest praise, though in some the authoress seems to have gone beyond reasonable bounds. For instance, after a most clear and excellent illustration of the method by which the distance of the moon from the earth is determined, in which the children are made to find by folding paper how far it is from the table to a ball hanging up in the room, the imagination of the reader is stimulated as follows:—

"At the beginning of our 'talk' about the moon, I tried to impress upon you what old travellers you were. Do you remember how far you have been each year? (585,000,000 miles.) And you, Tom, are—?" "Seven." "What age are you, Percy?" "Eight." "And you, Minnie?" "Nearly eight." "You shall work that sum out for me on your slates. We will neglect the travelling since last birthday. Multiply 585,000,000 by 8, Percy. Four thousand six hundred and eighty millions of miles, you say. Have you felt any pain or sickness? Are you willing then to accompany me for a little 'out' to call on our next neighbour, the moon? It is only 240,000 miles, and would take us a little over three hours and a half at earth's usual rate of travelling. Do you think your mothers would trust you with me if I guaranteed to bring you safely back again? Most of you say 'Yes.' What is it that Ethel is saying to you, Lucy?" "She wants to know if we are really going, or if it's 'only pretending.'" "That is a question which Ethel must decide for herself. Those who are going with us must be ready in time, or they will be left behind. Before we make a journey it is usual to consider, not merely the distance, but a few other matters also, such as—'What to take with us,' 'How long we shall be away,' 'Where we can get lodgings,' 'Whether we should take shawls, umbrellas, &c.,' and so many other considerations, that I am afraid we can't go to-day. Make all inquiries at home, and let me know how many of you are prepared to go."

As has been stated, the imagination rather than the reason is being constantly appealed to, and for the purpose the most picturesque language is employed. Perhaps the most striking example is to be found in a chapter headed, "The Mill with Stained Glass Windows." A beam of sunlight is made to pass through a condenser and into a slit. Then slips of coloured glass, red, green, and violet, are placed edge to edge over the slit, and the red-green-violet line of light is looked at through a scratch in a piece of smoked glass. The resulting diffraction phenomenon is the mill with stained glass windows. The upper story with violet windows has a greater number closer together than the second story with the green windows, and there is the same difference between this

and lower story with the red windows. From this result by a simple step the coloured bands seen when white light is employed are readily explained. Of course, and wisely so, no attempt is made to explain why with monochromatic light the windows are seen at all. In the same manner most of the phenomena described or which can be observed by following the clear and simple directions are stated to be what they are, rather than proved or explained. The authoress, guided by her own experience as a school-mistress, is probably right in continually pointing out fresh phenomena of interest, which may or may not be immediately forgotten, rather than in wearying the child with difficult arguments which could at best be imperfectly understood, and which would be sure in many cases to awaken a feeling of disgust. In short, *Sunshine* is a kindergarten and not a school.

Simple and homely language is employed with the greatest propriety, but occasionally it tends to be vague or even to produce a wrong impression. One or two actual mistakes may be referred to in order that they may be corrected in a future edition.

Thus, it is stated that as a rainbow entirely vanishes when the sun is as much as 42° above the horizon, we can never see one at noon. "In the summer" should obviously be added. The reader is told to spin a top carrying a disk painted half yellow and half blue and he will see green. There is a confusion here between the colour obtained by adding two colours as by spinning, and that which is the result of mixing pigments. As is well known, green is not produced under these circumstances, but white or nearly white. The four chapters on soap bubbles, which contain much that is sure to please, are supplemented by some special instructions, which, however, are not quite correct. Fig. 167 is an illustration of an experiment purporting to measure the surface-tension of a soap bubble by the depression of the water level in a quill tube dipping into a glass of water. As the bubble is drawn much larger than the two hands, the pressure within it would not produce any depression of the water below the general level. It would not even visibly affect the capillary elevation. Then it is stated that the surface-tension of pure water is 16.62 grains per square inch. It is, as a fact, a little over three grains per linear inch. The confusion becomes greater in the passage, "We know exactly how much energy it (the elastic film of water) has—16.62 grains per square inch. A tube of 1-inch bore will lift up 16.62 grains of water."

There is one serious fault in the book. Serious because an experiment is described as though it were being performed to an audience which is not only impracticable and impossible, but which would require in a soap-film a property different in kind to that which it possesses. A school-slate frame with one end removed is hung up so that the remaining end is uppermost. A knitting-needle is cut of such a length that it will slide freely in the groove made to hold the slate. From the knitting-needle a pill-box is hung by threads. The object is to weigh a letter. A soap-film is spread over the frame as far as the knitting-needle.

"See how the film is stretching, the knitting-needle is bringing it down like a blind. Now we place a letter in

the balance. I know that it weighs just half an ounce, so I can mark on the slate-frame with my blue pencil the place where the knitting-needle stops for half an ounce. I see I was not mistaken in what would take your fancy! I will hang it up here. You shall make one for yourselves, and spend what time you please with it. You will not then easily forget how elastic the film is."

Now the surface tension of a soap film is so small that if the knitting-needle and pill box weighed nothing the slate frame chosen must have been eight or nine feet across, and the knitting-needle the same length; or if the letter and the pill box weighed nothing the knitting needle, if of steel, must have been a great deal finer than any in ordinary use. But even if the experiment were being performed on a minor planet, instead of at Manchester, where with diminished gravitation the half-ounce knitting-needle and pill box would only just be sufficient to balance the tension of the soap film, the description would give the false impression that like a metal or other spring the tension of the soap film increases as the film is stretched, and so is able to rest steadily at some point which depends on the stretching weight. One obviously invented experiment described with all the circumstance and detail that this is, is sufficient to shake one's faith in the genuineness of other demonstrations.

C. V. B.

STRETTON ON THE LOCOMOTIVE.

The Locomotive Engine and its Development. By Clement E. Stretton, C.E. (London: Crosby Lockwood and Son, 1892.)

THE author of this work is well known to the railway world as one who has long taken a great interest in everything pertaining thereto. No one probably has a better knowledge of the history and development of the locomotive. It is with much pleasure we welcome the volume before us. The author very properly gives to Trevithick the name of "Father of the Locomotive," he having used high-pressure steam, the smooth rail, and the blast pipe, some years before either Hedley or Stephenson began to experiment. It is a pity so many men connected with the early progress of the locomotive should have been lost to fame; all did their share—the few only have been handed down to posterity. William James, for instance, certainly should not be forgotten, he having had a large share of the work in proving the locomotive to be a suitable machine for hauling trains, as against the system of fixed engines and rope haulage, and to him is largely due Stephenson's success on the Liverpool and Manchester Railway.

Richard Trevithick was born April 13, 1771, in the parish of Illogan in Cornwall. He was a mechanical genius in many ways. His first engine was made in the year 1803. This engine ran on four wheels, the boiler was arranged horizontally and had a wrought iron return fire-tube; the cylinder was $8\frac{1}{4}$ inches in diameter, and the piston had a stroke of 4 feet 6 inches. It was arranged horizontally, the crosshead driving a shaft in front of the boiler by means of a return connecting-rod. This